09/724,633.

CofC

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Bakker et al. Attorney Docket No.: KLA1P163/P705

Patent: 6,999,614 B1 Issued: February 14, 2006

Title: POWER ASSISTED AUTOMATIC SUPERVISED CLASSIFIER CREATION TOOL FOR SEMICONDUCTOR DEFECTS

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as first-class mail on December 1, 2006 in an envelope addressed to the Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450.

Signed: _____

Aurelia M. Sanchez

REQUEST FOR CERTIFICATE OF CORRECTION OF OFFICE MISTAKE (35 U.S.C. §254, 37 CFR §1.322)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Attn: Certificate of Correction

Dear Sir:

Attached is Form PTO-1050 (Certificate of Correction) at least one copy of which is suitable for printing. The errors together with the exact page and line number where the errors are shown correctly in the application file are as follows:

TITLE PAGE:

1. In page 2 of the Title Page, under "Other Publications" section, change "Kamowski, Thomas P." to --Karnowski, Thomas P.-- This appears correctly in the Information Disclosure Citation as filed by Fenwick & West, LLP on March 13, 2001.

SPECIFICATION:

1. Column 4, line 30, change "Selectron Method" to --Selection Method--. This appears correctly in the patent application as filed on November 28, 2000, on page 6, line 19.

2. Column 8, line 3, change "than improves" to --then improves--. This appears correctly in the patent application as filed on November 28, 2000, on page 12, line 10.

3. Column 8, line 40, add --classifier 1004, including a natural grouping process 1054, an automatic supervised-- after "of". This appears correctly in the patent application as filed on November 28, 2000, on page 13, lines 8-9.

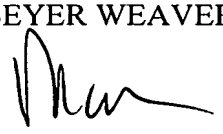
4. Column 8, line 43, change "grouping" to --groupings--. This appears correctly in the patent application as filed on November 28, 2000, on page 13, line 11.

5. Column 8, line 45, change "of defect" to --of the defect--. This appears correctly in the patent application as filed on November 28, 2000, on page 13, line 12.

Patentee hereby requests expedited issuance of the Certificate of Correction because the error lies with the Office and because the error is clearly disclosed in the records of the Office. As required for expedited issuance, enclosed is documentation that unequivocally supports the patentee's assertion without needing reference to the patent file wrapper.

It is noted that the above-identified errors were printing errors that apparently occurred during the printing process. Accordingly, it is believed that no fees are due in connection with the filing of this Request for Certificate of Correction. However, if it is determined that any fees are due, the Commissioner is hereby authorized to charge such fees to Deposit Account 500388 (Order No. KLA1P163).

Respectfully submitted,
BEYER WEAVER & THOMAS, LLP



Mary R. Olynick
Registration No. 42,963

P.O. Box 70250
Oakland, CA 94612-0250
650-961-8300

DEC - 8 2006

FORM PTO-1449 (REV. 6-89) U.S. DEPARTMENT OF COMMERCE Patent and Trademark Office

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

Attorney's Docket No.	Serial No.
4616 US	09/724,633
Applicant	
Bakker, et al.	
Filing Date	**Group Art Unit**
November 28, 2000	To Be Assigned

U.S. PATENT DOCUMENTS

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	A	5 2 2 6 1 1 8	07/6/93	Baker et al.	395	161	01/29/91

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation Yes	Translation No
	B	WO99/59200	18/11/99	PCT				
	C	WO99/67626	29/12/99	PCT				
	D	WO00/03234	20/01/00	PCT				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	E		Extended Kohonen Maps web pages [online] [retrieved on 1999-10-28]. Retrieved from the Internet: <URL: http://www.grid.let.rug.nl/~kleiweg/kohonen > 6 Pages
	F		Karnowski, Thomas P., Tobin, Kenneth W., Gleason, Shaun S., Fred Lakhani "The Application of Spatial Signature Analysis to Electrical Test Data Validation Study" Oak Ridge National Laboratory, Oak Ridge, TN 37831-6011, Sematech, Austin, TX 78741-6499, 12 Pages
	G		Electroglas.com web pages, "Spatial Pattern Recognition" [online] [retrieved on 2000-11-28]. Retrieved from the Internet: <URL: http://www.electroglas.com/products/knights_datasheets/spar_ds.htm > 4 Pages
	H		Dym.com web pages, "Spatial Signature Analysis (SSA)" [online] [retrieved on 2000-11-28]. Retrieved from the Internet: <URL: http://www.dym.com/ssa.htm.> 2 Pages
	I		Oak Ridge National Laboratory web pages, "ORNL-SEMATACH Computing Tools Helps U.S. Semiconductor Industry Identify Manufacturing Problems" [online] [retrieved on 2000-11-28]. Retrieved from the Internet: <URL: http://www.ornl.gov/Press_Releases/archive/mrl19980804-00.html> 2 Pages
	J		ISMV Semiconductor web pages, "Semiconductor Spatial Signature Analysis (SSA)", [online] [retrieved on 2000-11-28]. Retrieved from the Internet: <URL: http://www.ismv.ic.ornl.gov/projects/SSA.html> 6 Pages.

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if references considered, whether or not citation is in conformance with MPEP § 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

PTO-1449
REV: 12/96

In another embodiment, the inspection and analysis/classification process is performed in real-time during the inspection process instead of as a separate process. (An example of this is shown in the system of Fig. 10(c)). In such a system, inspection system 1052 is shown inside the system 1004 to indicate that it is part of the same system as the classifier 1056.

Fig. 2 is a block diagram showing the interaction of a human user with an embodiment of defect classifier software. A working set 208 of images, such a wafer defect images, is displayed for user review (as discussed below in connection with Fig. 3). A human user 210 can review the defect images in the working set.

The human user can also request that the images be organized by natural grouping 212 and displayed according to this organization. The human can manually classify the defect images into classes (also called "bins") according to the human's understanding of the type of defect represented by the image. Currently, the extracted features of the defect images are used to naturally group the defect images, using a Kohonen mapping technique. Kohonen mapping is described, for example in T. Kohonen, "The Self-Organizing Map," Proceedings of the IEEE, Vol. 78, 1990, pp. 1464-1480, which is herein incorporated by reference. Other methods can be used for natural grouping, such as a K-means; the method described in N. Otsu, "A Threshold Selection Method from Gray-Level Histograms," IEEE Trans. Systems, Man, and Cybernetics, Vol. SMC-9, 1979, pp.62-66 (which is herein incorporated by reference); or any other appropriate technique or method that groups defect images according to common features. In a described embodiment, both the natural grouping 212 and the automatic classifier 204 use the same feature set.

In addition, the human user can select images from the working set to be placed in a "training set" of images. The user then manually adds images/defects to the class/bins of the training set. Features are extracted from the selected images and stored along with the class/bin during a "train classifier" operation. The classifier then classifies a set of images (such as the set W-T) and the user reviews the errors found in the classifier's decisions. For example, the user may view the confusion matrix to determine where the classifier differed form the user's classifications. The user then

group code (reflecting its natural group) and a number of defect images currently assigned to the class/group. The user can, of course, add and delete classes/bins as he wishes (e.g., via the toolbar).

If the user wants to add a new class/bin, the class/bin is added. Other wise, an existing class/bin is opened. The user then manually adds images/defects to the class. Features are extracted from the selected images and stored during a "train classifier" operation (e.g., via the toolbar). The classifier then classifies a set of images (such as the set W-T) and the user reviews the errors found in the classifier's decisions. For example, the user may view the confusion matrix to determine where the classifier differed form the user's classifications. The user then improves the training set by adding deleting, or reclassifying images via, e.g., a drag and drop interface and reassesses the classifier's performance until a satisfactory result is achieved.

Fig. 8 shows an example user interface that includes a "Smart Gallery" setup function 802, an Auto Classifier Creation function 804, and a Classifier function 806. The Smart Gallery setup function leads to the user interface of Fig. 3. The classifier function leads to the user interface of Fig. 9. "Smart Gallery is a trademark of KLA-Tencor Corporation.

Fig. 9 shows an additional user interface for an embodiment of the Automatic Classifier Function. This embodiment is an alternative to the toolbar-driven, drag and drop method. Using this interface, a user can add defect images to the training set 902 and specify the features to extract for natural grouping and for the feature extractor of the classifier 904. The user can specify the number of features to extract (here, 80). When the user selects a Train button 906, the features of the images in the training set are extracted and saved as feature vectors for each image. The class/bin of each image is saved in association with the feature vector.

The user can set filters 908 on the images, removing certain groups, images, and types of images from the features extraction process. The user can also adjust the confidence of the feature method methods used by the classifier 204 using button 910.

When the user clicks Test (Training set) button 912, the classifier 204 classifies the set of images W-T into the bins in the training set in accordance with the feature vectors of the images in the training set.

Figs. 10(a) and 10(b) are block diagrams of systems in accordance with the present invention distributed over a network, such as the internet or an intranet. In Fig. 10(a), an optical, ebeam, or other types of inspection systems 1002, a classifier 1004/104, and an analysis system 1006 (see Fig. 1) are distributed over the network. In Fig. 10(b), elements of classifier 1004, including a natural grouping process 1054, an automatic supervised classifier 1056/204, and a feature extractor 1058, are distributed over the network. Natural grouping process 1054 receives as inputs the features of the working set and outputs the natural groupings of the working set. Automatic supervised classifier 1056 receives the features and classes of the training set and the features of the defect images, while outputting the classes of the defect images being classified. Feature extractor 1058 receives images and outputs features of the images.

Fig. 10(b) also shows an embodiment in which the classifier receives tool history 1005 as an input. Tool history includes, for example, the maintenance history of the tools or machine performing the inspection process and/or the manufacturing process. If the tool has been maintained according to its suggested maintenance schedule, its data may be weighted more than data from an unmaintained tool. Tool History 1055 may also include a threshold of inspection value, indicating that maintenance must be found in order for the classifier to give credence to the data from that tool. This threshold may vary for individual tools or may be the same for all the tools of a particular type or function. Tool history may also indicate, for example, whether two runs of semiconductors where taken from the same tool (or which tool they were taken from). Thus, tool history 1055 may include, for example, equipment Ids. If it is known, for example, that Tool A has had problems in the past, data from tool A may be treated differently than data from a trouble-free tool B.

As described above, Fig. 10(c) shows that the inspection and analysis/classification process is performed in real-time during the inspection process instead of as a separate process. In such a system, inspection system 1052 is shown

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Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(Also Form PT-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,999,614 B1 Page 1 of 1

DATED : February 14, 2006

INVENTOR(S) : Bakker et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

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MAILING ADDRESS OF SENDER:

PATENT NO. 6,999,614 B1

Mary R. Olynick
BEYER WEAVER & THOMAS, LLP
P.O. Box 70250
Oakland, CA 94612-0250

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